

## SOW SEASONAL INFERTILITY\*

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*SUMMARY: The level of reproductive efficiency is predominantly related to the values of the basic parameters of sow fertility, such as weaning-to-estrus interval, farrowing rate (%) and litter size. These values, however, were frequently reduced, in the warmer part of the year. This phenomenon is defined as seasonal sows infertility. This paper review the basic factors of sows seasonal infertility, their mechanisms of action, as well as the possibilities of practical solutions of this significant problem in pig reproduction.*

**Key words:** season, infertility, factors, sow.

### INTRODUCTION

The most significant parameters of sows reproductive efficiency are: duration of weaning-to-estrus interval, farrowing rate (%) and the number of live-born pigs per litter (Nielsen, 1981a; Tomes et al., 1982; Stančić, 1994). Significant reduction of fertility is evident during the warm summer months. This phenomenon is known as "seasonal infertility in pigs" (Vanroose et al., 2000). Namely, for as long as 40 years, considerably lower values of sow fertility parameters have been evident in the warmer part of the year (Almond, 1992). Thus, Aumaitre et al. (1976) determined significantly lower farrowing rates, extended weaning-to-estrus interval, increased number of irregular rebreeding and the reduced number of live-born pigs per litter in the warm part of the year. This phenomenon is related to the negative effect of increased ambient temperature on sow reproductive functions (Gordon, 1997).

Although the majority of seasonal infertility factors are well-known, the interaction and its mechanisms are not entirely clarified and, therefore, there is no single adequate technology for solving this problem. Therefore, examining this problem is always important. Accordingly, the aim of this paper is to review some of the recent findings regarding the phenomenon of seasonal infertility in sows.

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## SEASONAL INFERTILITY

Seasonal infertility is defined as a phenomenon of occurrence of lower values of the basic parameters of sow fertility during the summer months. Some of these parameters are: extended weaning-to-estrus interval, lower values of conception rate, increased number of rebreeding, abortions and pseudopregnancy, as well as the lowered number of vital live-born pigs (Love, 1978; Rozeboom et al., 2000). The decrease of the stated fertility parameters during warm summer months was perceived as an important factor causing economic losses in intensive herds of domestic pig breeds in as early as 1970s (Gordon, 1997; Peltoniemi et al., 1999). Accordingly, Aumaitre et al. (1976) in France determined that the weaning-to-estrus interval is longer for averagely 10 days in the sows farrowed in the warm period of the year (June-September), compared with the other, colder period of the year. Likewise, the USA researchers determined the considerably extended weaning-to-estrus interval (Hurtgen et al., 1980), as well as the period of successive farrowing during the warm period of the year (Hurtgen i Leman, 1981).

The research conducted by Peltoniemi et al. (1999), on 1080 breeding herds in Finland, showed that the decrease of sow fertility during the summer period was reflected in the following: (1) significantly increased number of sows weaned due to prolonged post-lactation anestrus, (2) considerable increase of rebreeding, (3) considerable increase of sows whose weaning-to-estrus interval was significantly longer than 10 days, (4) significantly increased number of pseudopregnant sows (inseminated, they do not rebreed, but are not pregnant), and (5) substantially increased number of sows with inactive ovaries, determined by examination of sexual organs on dead animals. The results of the research conducted in the Eastern Europe, on a great number of breeding herds, during a number of years, also indicate significant decrease of weaning-to-estrus interval, farrowing rate and live born piglets per litter, as well as the regular and irregular returns in the warm season (Almond and Bilkei, 2005).

Summer infertility was considerably more frequent in gilts, compared with sows (Britt et al., 1983). Research conducted by a number of authors, according to Gordon (1997), indicated to the general conclusion that the parameters of sow fertility during the warm season are reduced 15 to 20% compared with the cold period of the year.

Summarizing the results of the mentioned authors, as well as the results of certain other authors, analysed by Stančić et al. (2002) review paper, it can be concluded that the seasonal infertility is manifested most in considerably extended weaning-to-estrus interval, decrease of farrowing rate (%), as well as lowering of the number of vital live-born pigs per litter.

***Weaning-to-estrus interval (WEI).*** In good herds, over 85% of sows manifest the first estrus within 7 days after weaning (Tubbs, 1990). The intervals longer than this are considered to be extended (abnormal) and they are an indication of disturbed activity of re-establishing post-lactation ovary activity, as well as of the possibility of lower reproductive efficiency of such sows in the following reproductive cycle (Napel et al., 1998). Postponing of re-establishing post-lactation ovary activity (follicular growth, ovulation and estrus manifestation) is, most frequently, the consequence of prolonged daily photoperiod and the increase of ambient temperature during warm months (Peltoniemi et al., 1999). It appears that the extended WEI during the summer season is the consequence of reduced capability of hypothalamus to re-establish normal pulsatile secretion of Gn-RH. This inhibits the release of hypophyseal gonadotropins (FSH and LH), which

results in postponement of the first post-lactation ovulation and manifestation of estrus (Prunier et al., 1996). The effect of the increased ambient temperature on the extension of WEI can be explained indirectly. Namely, it is well-known that the appetite of sows is significantly lowered during the summer months (Aherne and Kirkwood, 1985), and that reduced intake of energy in the organism reduces or inhibits secretion of LH (Prunier et al., 1996). This results in postponement of maturing and follicle ovulation after weaning and, consequently, extension of WEI (Kirkwood, 2009). On the other hand, the extended daily photoperiod has direct effects, through the influence of the reduced pineal melatonin secretion on the inhibition of Gn-RH secretion in hypothalamus and, consequently, omission of hypophyseal gonadotropin secretion (Tast, 2002).

**Farrowing rate.** Considerably lower sows farrowing rate, during the summer months, significantly lowers economic efficiency of production. The most frequent reason for farrowing failure, i.e. unsuccessful conception, in summer months is irregular rebreeding, that is, re-establishment of estrus 25 to 35 days after insemination. Such early pregnancy loss is a consequence of embryo mortality (Xue et al., 1994) or the regression of pregnancy corpora lutea (Wrathall et al., 1986). Namely, recent research indicates that high ambient temperature leads to the increased embryo mortality, and consequently, to pregnancy loss (Stančić et al., 2004). Besides, it seems that the increased temperature inhibits prolactin (LTH) release from hypophysis, which is necessary for enhancement of secretory activity of corpora lutea after 16<sup>th</sup> day of gestation, which also causes pregnancy loss and irregular rebreeding (Tast et al., 2002). Certain research indicates that seasonal pregnancy loss, however, is the consequence of oversensitivity of the corpus luteum of pregnancy to increased ambient temperature, which inhibits secretion of progesterone (Kirkwood, 2009).

**Litter size.** The results on the effects of a season on litter size at farrowing are rather contradictory. This can be attributed to the fact that, on one hand, litter size is influenced by the interaction of a numerous genetic and paragenetic factors, and of different conditions and research methods, on the other hand (Stančić et al., 2002). Even if there is the influence of the season on the number of live-born pigs per litter, it can be indirect. Namely, it is well known that sows with extended weaning-to-estrus interval, which occurs frequently in summer, have substantially lower number of piglets in the resulting litter (Borchardt Netto, 1998; Wettmann and Bazer, 1985; Stančić, 1997a and 1997b; Stančić et al., 2000). Furthermore, in the warm period of the year, the piglets mortality during lactation period is increased, as well, which also significantly decreases the total number of produced piglets per sow on the annual basis (Gagrčičin et al., 2007). The presented results show that the phenomenon of seasonal infertility in sows is very complex, and that its physiological basis has not been entirely clarified. However, the results of all the research consistently indicate that the lowered fertility in sows is the consequence of the interaction of high ambient temperature and extended daily photoperiod in the warm period of the year. These factors take effect through neuroendocrine activity at the level of central nervous system – hypothalamus – hypophysis – ovaries (Tast, 2002). Such effects of a season on domestic pig breeds can be based on the fact that domestic pig breeds originate from European wild boar, which is especially seasonally sexually active, as their mating season is in the cold period of the year. This accounts for the seasonal effect of the extended daily photoperiod on neuroendocrine mechanisms regulating cyclic ovarian activity and estrous cycle manifestation (Mauget, 1982).

**Seasonal infertility control.** The phenomenon of seasonal infertility in sows is very complex as it includes both direct and indirect interactions of a great number of genetic and paragenetic factors, whose mechanisms of physiological performance is not entirely clarified (Kirkwood, 2009). Therefore, it is impossible to define a single simple technology which would entirely eliminate the effects of this phenomenon on productive efficiency of breeding herds in intensive pig production today. Nevertheless, on the basis of the results of numerous research, as well as practical experience, during the last 40 years, it is possible to point out certain zoo-technological and sanitary-veterinary measures, which can significantly contribute to the increase of sow fertility in the warm period of the year.

According to the results of a number of authors, summarized by Rozeboom et al. (2000) and Stančić et al. (2002), these measures are the following:

- Provide effective ventilation and cooling system of the facilities.
- Build eaves above pens for sows and gilts.
- Provide cold and clean drinking water *ad libidum*.
- Distribute daily meals in a number of small meals during the day.
- Reduce the quantity and increase the energy value of daily meals.
- Make sure that food contains no mycotoxins.
- Detect estrus at least 2 times a day, every 12 hours, with the direct boar contact.
- Control the quality of every single boars ejaculate, and make a smaller number of inseminating doses, with the increasing number of progressive motile spermatozoides.
- Apply the third insemination in sows which exhibit the “standing heat” 12 hours after the second insemination.
- Perform insemination with adequate catheters, with cervix stimulation, and maximal hygiene of the entire process of artificial insemination.
- Eliminate the physical activity of sows as much as possible
- Avoid transport and/or relocating sows
- Reduce the number of sows per group
- Increase the number of inseminated gilts during the period July-September.
- Ensure high level of hygiene of the animals and facilities
- Maintain good health and stamina of animals
- Treat the breeding sows, especially gilts, with gonadotropin preparations (PMSG+HCG) around 24 hours after weaning, to increase the level of estrus reaction within the first 7 days after weaning, in order to ensure better synchronisation of ovulation and the increase of ovulation rate, well as conception rate.

## DISCUSSION

The decreasing fertility during summer, known as “summer or seasonal infertility syndrome” (Love, 1978; Rozeboom et al., 2000), causes considerable zoo-technological and sanitary-veterinary problems, as well as economic losses in the intensive pig production. Although the domestic pig breeds are reproductively active during the whole year (manifesting ovulatory estrus and being capable for fertilization) (Mauget, 1982), there is the evident difference in values of all the parameters of fertility (duration of weaning-to-estrus interval, conception rate, rebreeding rate and abortions, as well as the average litter size) between the cold and warm periods of the year (Rozeboom et

al., 2000; Stančić et al., 2002). Namely, substantially lower values of the mentioned parameters of fertility during warm summer months were recognized as a significant factor of economic losses in intensive breeding herds of domestic pig breeds in as late as 1970s (Aumaitre et al., 1976). Summer infertility is much more frequent in gilts, than in sows (Britt et al., 1983). The research of a number of authors, according to Gordon (1997), point to the general conclusion that the parameters of sow fertility, during the warm summer period of the year, decrease for 15-20% compared with the cold period of the year.

Such highly significant differences in the duration of WEI in the cold and warm periods of the year have been recognized by Aumaitre et al. (1976), Hurtgen et al. (1980), Peltoniemi et al. (1999), Stančić et al. (2002) and Almond and Bilkei (2005). In Eastern European countries, this interval lasts 5.9 days on average in the cold and 7.8 days in the warm period of the year (Almond and Bilkei, 2005). The extended duration of WEI reduces reproductive efficiency of breeding herds both directly and indirectly. Firstly, the reproductive efficiency is reduced directly, as sows with extended WEI achieve lower farrowing rates after insemination in the first post-lactation estrus and have a significantly lower number of pigs per litter (Stančić, 1994; Kemp and Soede, 1996; Stančić, 1997a and 1997b; Borchardt Netto, 1998; Stančić, 2000; Stančić et al., 2002; Timotijević et al., 2003). Secondly, the reproductive efficiency is reduced indirectly, as the extended WEI prolongs the interval between successive farrowing and, consequently, reduces the farrowing index, resulting in the reduced yearly pig production and the increased number of non-productive feeding days (Tomes et al., 1982; Tubbs, 1990; Stančić, 2005). According to the research conducted by Prunier et al. (1996), the extended WEI during the warm period of the year is a consequence of the decreased capability of hypothalamus to re-establish the normal pulsatile secretion of Gn-RH. This inhibits the release of hypophyseal gonadotropin (FSH and LH), which results in postponement of the first post-lactation ovulation and estrus manifestation.

The farrowing rate is also statistically lower in the warm than in the cold period of the year. Thus, Almond and Bilkei (2005) determined that this value reaches 91% in the cold and 78% in the warm periods of the year. The most frequent reason for farrowing failure, i.e. unsuccessful conception, in summer months is irregular rebreeding, that is, re-establishment of estrus 25 to 35 days after insemination. Our previous research (Stančić, 2002) also determined the statistically significant ( $P > 0.01$ ) increase in irregular rebreeding in the warm (53.4%) compared with the cold period of the year (27.5%). Such early pregnancy loss is a consequence of embryo mortality (Xue et al., 1994) or the regression of corpora lutea of pregnancy (Wrathall et al., 1986). Namely, recent research indicate that high ambient temperature leads to the increased embryo mortality, and consequently, to pregnancy loss (Stančić et al., 2004). Besides, it seems that the increased temperature inhibits prolactin release from hypophysis, which is necessary for enhancement of secretory activity of corpus luteum (CL) after 16<sup>th</sup> day of gestation, which also causes pregnancy loss and irregular rebreeding (Tast et al., 2002; Kirkwood, 2009). According to the research of certain authors (Christianson, 1992), abortions were most frequently caused by infectious factors, and less frequently by stress induced by increased ambient temperature.

The average number of live-born and the total number of pigs per litter is lower, while the number of avital, mummified and stillborn pigs increases during the warmer period of the year (Almond and Bilkei, 2005). However, the views on the effects of a

season on litter size are quite contradictory (Stančić et al., 2002). Even if there is the effect of a season on the number of live-born pigs per litter, it can be indirect. Namely, it is well-known that sows with extended weaning-to-estrus interval, which is frequent in the summer period, have significantly lower number of pigs per litter (Borchardt Netto, 1998; Wettemann and Bazer, 1985; Stančić, 1997a and 1997b; Stančić et al., 2000). Moreover, during the summer months, embryo mortality is increased, and consequently, the number of live-born pigs per litter decreases (Stančić, 1991; Christianson, 1992; Xue et al., 1994; Stančić, 1995; Tast et al., 2002; Stančić et al. 2004). Certain authors point out that the stress induced by increased ambient temperature reduces sows immunity to infectious diseases which causes increased mortality and/or fetal mummification (Yeske, 2007; Givens and Marley, 2008).

Quick (within 7 days) re-establishment of ovary activity (follicular growth and ovulation) and estrus manifestation after lactation are the basic factor of the efficient reproductive activity of sow. However, during the warm days the weaning-to-estrus interval is significantly extended. Therefore, the PMSG treatment is used, in order to increase the synchronization of the occurrence of estrus in as many sows as possible within the first 7 days after weaning (Bracken et al., 2006). Franek and Bilkei (2008) determined that within 7 days after weaning in the warm period, 94% of sows treated with PMSG and 75% of control ones (without treatment) manifested estrus. The average duration of the weaning-to-estrus interval was 3.8 days in the treated sows, and 6.2 days in the control sows. Better synchronization of estrus, shortened weaning-to-estrus interval and increased fertility rate in PMSG treated sows during the warm period was also recognized by other authors (Stančić and Šahinović, 1991; Grafenau et al., 1997; Taker et al., 2008).

The results of the presented research clearly indicate that the values of the examined parameters of fertility in sows are significantly lower during the warm period compared with the cold period of the year. Furthermore, these parameters indicate considerably higher decrease in gilts than in sows.

The phenomenon of the sows seasonal infertility is very complex. The precise mechanisms of physiological basis of this phenomenon have not been entirely clarified (Kirkwood, 2009). However, the results of all the research consistently indicate that the lowered fertility in sows is affected by the interaction of high ambient temperatures and extended daily photoperiod in the warm period of the year. These factors take effect through neuroendocrine mechanisms at the level of central nervous system – hypothalamus – hypophysis – ovaries (Tast, 2002). Such effects of a season on domestic pig breeds can be based on the fact that domestic pig breeds originate from European wild boar, which is especially seasonally sexually active, as their mating season is in the cold period of the year. This accounts for the seasonal effect of the extended daily photoperiod in the warm period of the year, as the seasonal sexual activity is the consequence of the direct effect of photoperiod on neuroendocrine mechanisms regulating cyclic ovarian activity and estrous manifestation (Mauget, 1982).

Although all the factors of seasonal infertility, as well as the mechanisms of their physiological effects are not clearly elucidated, it is possible to decrease the negative effects of the warm period of the year on sow fertility to a certain extent by using adequate technologies of housing, insemination, health care and by treating sows with gonadotropin preparations (Rozeboom et al., 2000; Stančić et al., 2002).

## CONCLUSION

On the basis of the presented results, regarding the infective and non-infective etiology of sows, it is possible to conclude the following:

- 1) Non-infectious factors which cause pig infertility are numerous, the most significant of which would be the effects of increased ambient temperature and the extended duration of daily photoperiod during the warmer period of the year. In this period, there is a substantially extended weaning-to-estrus interval, the reduced number of estrous sows within 7 days after weaning, significantly lower farrowing rate (%), significantly increased number of sows with irregular rebreeding (embryo mortality), and abortion, substantially higher number of stillborn avital and mummified pigs per litter.
- 2) Negative effects of the warm period of the year are more evident in gilts than in sows.
- 3) Although neither all the factors of seasonal infertility nor all of the mechanisms of their physiological effects are known, it is possible to reduce the negative effects of the warm period of the year on sow fertility to a certain extent by adequate technologies of housing, nutrition, insemination, health protection and gonadotropin preparation treatment for sows.

## REFERENCES

- AHERNE, F.X., KIRKWOOD, N.R.: Nutrition and sow prolificacy. *J. Reprod. Fert.*, 33:169-178, 1985.
- ALMOND, P.K., BILKEI, G.: Seasonal infertility in large pig production units in a Eastern-European climate. *Australian Veterinary Journal*, 83(6)344-346, 2005.
- ALMOND, W.G.: Seasonal infertility in female pigs. *Healthy Hogs*, 1:1-5, 1992.
- AUMAITRE, A., DAGORN, J., LEGAULT, C., LE DENMAT, M.: Influence of farm management and breed types on sows conception-weaning interval and productivity in France. *Livestock Prod. Sci.*, 3:75-83, 1976.
- BORCHARDT NETTO, G.: Causes of Variation of Oestrus Length and Onset of Oestrus-Ovulation Interval and their Relationship with Pregnancy Rate and Litter Size in Multiparous Sows. (PhD Dissertation), Institute for Reproduction, Hanover, 1998.
- BRACKEN, J.C., SEAMAN BIDGERS, S.J., SAFRANSKI, T.J., LUCY, C.M.: Ovarian follicular development, estrus and ovulation in seasonally anestrous sows treated seven days post weaning with equine and human chorionic gonadotropins. *J. Swine Health Prod.*, 14(4)207-209, 2006.
- BRITT, J.H., SZAREK, V.E., LEVIS, D.G.: Characterization of summer infertility of sows in large confinement units. *Theriogenology*, 20(1)133-40, 1983.
- FRANEK, P.S., BILKEI, G., KOVAČ, G.: Effect of gonadotropins during hot summer season given at different times after weaning an selected reproductive indicators of the sows. *Acta Vet. Brno*, 77:193-198, 2008.
- GORDON, I.: *Controlled Reproduction in Pigs* (Vol. 3). CAB Int., Oxon, UK, 1997.
- GRAFENAU, P., PIVKO, J., OBERFRANC, M., KUBOVIČOVA, E.: New possibility of estrus synchronization and superovulation in farm animals. *J. Agric. Sci.*, 43(6)383-390, 1997.
- HURTGEN, J.P., LEMAN, A.D.: Effect of parity and season of farrowing on the subsequent farrowing interval of sows. *Vet. Rec.*, 108:199-223, 1981.

- HURTGEN, J.P., LEMAN, A.D., CRABO, B.: Seasonal influence of estrus activity in sows and gilts. *J. Am. Vet. Med. Assoc.*, 170:709-713,1980.
- KEMP, B., SOEDE, M.N.: Relationship of weaning – to- estrus interval to timing of ovulation and fertilization in sows. *J. Anim. Sci.*, 74:944-949,1996.
- KIRKWOOD, N.R.: Managing seasonal infertility in sows. *Vets.Web.*, 11:1-12,2009.
- LOVE, J.R.: Definition of a seasonal infertility problem in pigs. *Vet. Rec.*, 103(20)443-446,1978.
- MAUGET, R.: Seasonality of reproduction in the wilde boar. *In: Control of Pig Reproduction* (D.J.A. Cole and G.R.F. Foxcroft, eds.). Butterworths, London. Pp. 509-526,1982.
- NAPEL, J., MEUWISSEN, T.H.E., JOHNSON, K.R., BARASCAMP, E.W.: Genetics of the Interval from Weaning to Estrus in First-Litter Sows – Correlated Responses. *J. Anim. Sci.*, 76:937-947,1998.
- NIELSEN, H.E.: Sow productivity. *Proc. Alberta Pork Seminar. University of Alberta*, pp. 1-17,1981a.
- PELTONIEMI, O.A., HEINONEN, M., LEPPÄVUORI, A., LOVE, R.J.: Seasonal effects on reproduction in the domestic sow in Finland: a herd record study. *Acta Vet. Scand.*, 40(2):133-44,1999.
- PELTONIEMI, T.A.O., LOVE, J.R., HEINONEN, M., TUOVINEN, V., SALONIEMI, H.: Seasonal and management effects on fertility of the sow: a descriptive study. *Anim. Reprod. Sci.*, 55:47-61,1999.
- PRUNIER, A., QUESNEL, H., MESSIAS, M., KERMABON, Y.A. (1996): Environmental and seasonal influence on the return-to-estrus after weaning in primiparous sows: a review. *Livestock Prod. Sci.*, 45:103-110,1996.
- ROZEBOOM, K., SEE, T., FLOWERS, B.: Coping with seasonal infertility in the sow herd: Part I. *Swine News*, 23(3)1-4,2000.
- STANČIĆ, B., ŠAHINOVIĆ, R.: Neki parametri reproduktivne performanse krmača posle tretmana placentalnim gonadotropinima. *Vet. Glasnik*, 45(6-7)413-417,1991.
- STANČIĆ, B.: Embrionalno ugibanje u svinja (pregled). VIII Seminar o savremenoj stočarskoj proizvodnji. Kupari, 3-10. februar, 1991. Zbornik radova, str. 145-156.
- STANČIĆ, B.: Razvoj embriona svinje i njegova uloga kod uspostavljanja i održavanja gravidnosti (pregled). Simpozijum: Naučna dostignuća u stočarstvu – 95. Novi Sad, 8-10. februar, 1995. Zbornik radova, str. 319-325.
- STANČIĆ, B.: Faktori koji utiče na neke parametre reproduktivne performanse krmača. *Vet. glasnik*, 48(5-6)345-472,1994.
- STANČIĆ, B.: Interval zalučenje-estrus u krmača. 1. Faktori koji određuju trajanje ovog intervala (pregled). *Vet. glasnik*, 51(3-4)109-118,1997a.
- STANČIĆ, B.: Interval zalučenje-estrus u krmača. 2. Uticaj trajanja ovog intervala na vrednost prašenja i veličinu legla (pregled). *Vet. glasnik*, 51(3-4)119-126,1997b.
- Stančić, B., Radović, I., Gagrčin, M. (2000): Interval zalučenje-estrus i njegov uticaj na fertilitet krmača (pregled). *Arhiv za poljop. nauke*, 61(213)85-92.
- STANČIĆ, B.: Uticaj sezone na fertilitet krmača (pregledni rad). *Vet. glasnik*, 56(1-2)97-104,2002.
- STANČIĆ, B., GAGRČIN, M., KOVČIN, S.: Mortalitet embriona svinje (pregled). *Veterinarki glasnik*, 58(3-4)481-491,2004.
- STANČIĆ, B.: Reprodukcijska svinja (monografija). Univerzitet u Novom Sadu, Poljoprivredni fakultet,2005.



- STRAUB, C.O.: The important viral infections in pigs. *Swine Health and Production*, 2(4)15-18,1994.
- TAKER, M.Y.C., BILKEI, G., KOVAČ, G.: Gonadotropin treatment prevents seasonal infertility in the sows. *Folia Veterinaria*, 52(2)106-108,2008.
- TAST, A., PELTONIEMI, O.A., VIROLAINEN, V.J., LOVE, R.J.: Early disruption of pregnancy as a manifestation of seasonal infertility in pigs. *Anim. Reprod. Sci.*, 74:75-86,2002.
- TIMOTIJEVIĆ, M., STANČIĆ, B., GAGRČIN, M.: Postlaktacijsko estrusno reagovanje i fertilitet krmača (monografija). Poljoprivredni fakultet, Novi Sad,2003.
- TAST, A.: Endocrinological basis of seasonal infertility in pigs. PhD Thesis, Faculty of Veterinary Medicine, Finland, Helsinki,2002.
- TOMES, J.G., NIELSEN, H.E.: Factors affecting reproductive efficiency of the breeding herd. *In: Control of Pig Reproduction* (D.J.A Cole and G.R. Foxcroft, eds.). Butterworths, London, pp.527-540,1982.
- TUBBS, C.R.: Factors That Influence the Weaning-to-Estrus Interval in Sows. *Comp. Cont. Education for the Pract. Vet.*, 12(1)105-115,1990.
- WETTEMANN, R.P., BAZER, F.W.: Influence of environmental temperature on prolificacy of pigs. *J. Reprod. Fert., Suppl.* 33:199-208,1985.
- WRATHALL, A.E., WELLS, D.E., JONES, P.C., FOULKES, J.A.: Seasonal variations in serum progesterone levels in pregnant sows. *Vet. rec.*, 118:685-687,1986.
- WRATHALL, E.A.: Investigation and control of reproductive disorders in the breeding herd. *In: Control of Pig Reproduction* (D.J.A. Cole and G.R.F. Foxcroft, eds.). Butterworths, London. Pp. 565-583,1982.
- XUE, J.L., DIAL, G.D., MARSH, W.E., DAVIES, P.R.: Multiple manifestations of season on reproductive performance of commercial swine. *J. Am. Vet. Med. Assoc.*, 204:1486-1489,1994.

## SEZONSKI INFERTILITET KRMAČA

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### Izvod

Nivo reproduktivne efikasnosti krmača primarno zavisi od parametara fertiliteta, kao što su interval zalučenje-estrus, vrednost (%) prašenja i veličina legla. Vrednosti ovih parametara su značajno redukovane tokom toplijeg perioda godine. Ovaj fenomen je poznat pod nazivom sezonski ili letnji infertilitet krmača. U ovom preglednom radu su opisani osnovni faktori sezonskog infertiliteta krmača, mehanizmi njihovog fiziološkog delovanja, kao i mogućnosti praktičnog rešavanja ovog značajnog problema u reprodukciji svinja.

**Ključne reči:** sezona, infertilitet, faktori, krmača.

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